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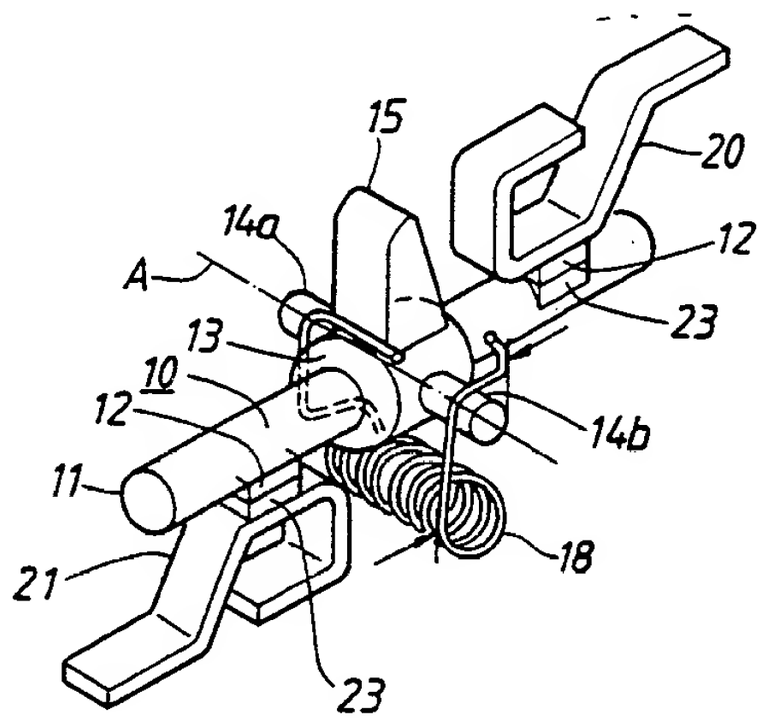
(54) Title: CONTACT ARRANGEMENT FOR ELECTRIC SWITCHING DEVICES



(57) Abstract

The invention relates to a contact arrangement particularly intended for current limiting low-voltage circuit breakers, the contact arrangement having an elongated movable contact (10) which, at its mid-point, is rotatably journalled about a rotational axis (A) directed perpendicular to the longitudinal axis of the contact. The movable contact cooperates with two fixed contacts (20, 21) which are arranged on opposite sides of the movable contact. In the closed position of the switching device, the movable contact is pressed against the fixed contacts with the aid of a torsion spring (18) which extends parallel to the rotational axis of the movable contact and which, on one side of the movable contact, is in engagement with the movable contact and, on the opposite side, is in engagement with the stand of the switching device.

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Contact arrangement for electric switching devices

TECHNICAL FIELD

The present invention relates to a contact arrangement of the kind described in the preamble to claim 1, intended for electric switching devices. The invention primarily relates to contact arrangements for current limiting circuit breakers for rated operating voltages of up to about 1000 V but it may, in principle, also be used with other types of low voltage electric switching devices.

BACKGROUND ART

Electric switching devices with rotatably journalled movable contacts and two series-connected breaking points per pole are previously known. In a switching device of this type described in EP-B-0 174 904, the necessary contact pressure is achieved with the aid of two helically wound torsion springs, arranged on opposite sides of the movable contact in each pole. In such a design, it is difficult to fulfil the requirements which are placed on modern electric switching devices with respect to small phase distances and a small width of the device.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a contact arrangement of the above-mentioned kind, which is particularly intended for current limiting circuit breakers and which requires a smaller phase distance than the above-mentioned known design. This is achieved according to the invention by designing the contact arrangement in the way described in the characterizing part of claim 1. By using, in each breaker pole, only one torsion spring, arranged in the manner stated in the claim, for achieving the required contact pressure, a simple design with few parts is obtained, in which the phase distance (i.e. the distance

between the mid-planes of adjacently located breaker poles) can be minimized. By designing the torsion spring as a helically wound spring, it may be designed relatively easily bendable so that it applies a substantially pure torsional moment to the movable contact. In this way, the frictional forces acting against the contact forces in the bearings of the movable contact will be small.

The movable contact may suitably be provided with a contact carrier, cast around the central part of the contact, with a bearing shaft, an operating arm and a spring attachment. This gives a simple design with few parts.

The torsion spring may advantageously be placed eccentrically in relation to the rotational axis of the movable contact. This makes possible a simple, straight shape of the contact.

The contact carrier is suitably designed such that the torsion spring may be clamped to the contact carrier during the mounting work. The movable contact with the contact carrier and the spring form a mounting unit which may be pushed into the breaker stand between two shielding walls provided with U-shaped guide slots for the bearing shaft of the contact. One end portion of the spring may be designed such that its engagement is automatically transferred to the adjacent shielding wall in connection with the mounting unit being pressed into position in the guide slots. This enables the mounting work to be carried out simply and rapidly.

Since the movable contact is journalled in U-shaped guide slots, the further advantage is achieved that the contact within certain limits may be displaced transversally in the plane of rotation, which makes it possible to take up deviations in the contact position. Such deviations are unavoidable and are due to manufacturing tolerances and contact wear.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be explained in greater detail by describing an embodiment with reference to the accompanying drawings, wherein

Figure 1 shows in perspective view a contact arrangement according to the invention,

Figures 2 and 3 show in side view the contact arrangement in its closed and open positions, respectively,

Figures 4 and 5 show how the movable contact carrier of the contact arrangement with its contact pressure spring is fitted into slot-shaped guides in the stand of an electric switching device, and

Figure 6 shows in perspective view how the contact arrangement may be arranged in an electric switching device.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The contact arrangement shown in Figures 1-3 has a movable contact 10 comprising a movable contact arm 11 made from round bar of, for example, copper, the ends of the contact arm supporting contact elements 12 of a suitable contact material, for example silver cadmium oxide or silver tin oxide. The central part of the contact arm is surrounded by a contact carrier 13, which is made of insulating material, for example plastic, and is fixed to the contact arm, for example by being cast thereon. The contact carrier 13 is formed with a bearing shaft 14, consisting of two shaft pins 14a, 14b directed in opposite directions, an operating arm 15 and a fixing slot 16 for a contact pressure spring 18. The shaft 14 is journalled in two mutually parallel shielding walls (not shown), arranged on opposite sides of the contact arm and forming part of the stand of the

electric switching device, the contact 10 being rotatable about a rotational axis A oriented perpendicular to the longitudinal axis of the contact.

The movable contact 10 cooperates with two fixed contacts 20, 21, arranged on opposite sides of the movable contact, each contact consisting of a contact arm 22 of copper with a contact element 23 of a suitable contact material. The contact arm 22 has a hook-like shape with two branches, one 24 of which constituting a connecting branch and the other 25 forming an arcing horn.

In the closed position of the electric switching device, the movable contact elements 12 are pressed against the fixed contact elements 23 with the aid of the contact pressure spring 18, which consists of a helically wound spring extending substantially parallel to the rotational axis A. On one side of the movable contact 10, the spring 18 is in engagement with the movable contact via the contact carrier 13, and on the other side of the contact the spring is in engagement with the stand of the electric switching device.

The contact carrier 13 and the torsion spring 18 are designed such that the spring 18 may be attached to the contact carrier 13 before the movable contact with the contact carrier and the spring is fitted into the electric switching device. Figure 4 shows the unit, consisting of parts 10, 13 and 18, prior to being fitted into the switching device. One end portion of the spring is thereby fixed in the fixing slot 16 of the contact carrier 13, whereas the other end portion of the spring, which portion is designed with a transversally projecting arm 19, is fixed by pressing the end portion by the spring tension against the contact carrier at the two points marked by the arrows B. The fitting into the switching device may be carried out in a simple and rapid manner by pressing in the mentioned mounting unit, in the direction of the arrow C, between two parallel shielding walls, associated with the stand of the

electric switching device, a portion 28 of one of these walls being schematically shown in Figures 4 and 5. The shielding walls are provided with U-shaped guide slots 29 for mounting the shaft 14 of the movable contact. That end portion of the spring 18 which is provided with the arm 19 will then be pushed into one of the guide slots 29, the width of which is somewhat larger than the outside diameter of the helically wound spring 18. The engagement of the spring is then transferred to the shielding wall at the points marked with the arrows D (Fig. 5). In the embodiment shown, the bearing shaft 14 of the contact carrier has an oval cross section, in which the largest dimension of the cross section corresponds to the width of the associated guide slot 29. The other guide slot 29, on the opposite side of the contact carrier 11, need only exhibit the necessary transversal play between the shaft pin 14a and the bottom of the slot. This slot, therefore, has a smaller depth than the guide slot which accomodates one of the end portions of the spring 18.

Figure 6 shows central parts of a three-pole electric switching device which is provided with the contact arrangement described above. The switching device is designed so as to combine the functions of a contactor, a direct-on-line starter and a current limiting circuit breaker. The main current path in each pole extends from an upper terminal clamp 31 via a bimetallic element 32 in a thermal tripping device, an upper fixed contact 21, a movable contact 10, a lower fixed contact 20 and a percussion armature magnet 33 to a lower terminal clamp 35. A deionization plate package 36 and 37, respectively, is arranged close to each one of the two series-connected breaking points in each breaker pole.

The electric switching device is provided with an operating magnet (not shown), which in activated state maintains the opening spring (or springs), not shown, of the switching device tensioned. The switching device is then in a closed

contact position by the influence of the contact pressure springs 18. For opening of the switching device during normal operation, for example when breaking normal operating currents and operating overload currents, the current to the coil of the operating magnet is broken by means of an auxiliary contact arranged in the operating circuit. This causes the force from the opening spring to influence the operating arms 15 via an operating member (not shown) common to all the poles, the movable contacts 10 thus being turned from the open position against the action of the contact pressure springs 18, which are weaker than the opening spring.

If a short circuit occurs in the circuit into which the electric switching device is connected, the percussion armature magnet 33 is activated, which magnet, via an arm 34 connected to the magnet armature, directly influences the contact arrangement in the phase (or the phases) in which a short circuit current occurs, a rapid current limiting breaking thus being achieved. At the same time, the current to the coil of the operating magnet is broken, permitting the movable contacts in all the poles to switch to the open position. The percussion armature magnet 33 may, for example, be of the type described in the patent publication WO 90/05368.

The invention is not limited to the embodiment shown but several modifications are possible within the scope of the claims. For example, the torsion spring 18 may be placed closer to the rotational axis A of the movable contact 10, or coaxially therewith. In that way, the swinging motion of that of the ends of the spring, which is in engagement with the contact carrier 13, is reduced. At the same time, however, the contact 10 must be bent to accomodate the spring.

CLAIMS

1. A contact arrangement for electric switching devices comprising an elongated movable contact (10), which at its mid-point is rotatably journalled about a rotational axis (A) directed perpendicular to the longitudinal axis of the contact and which cooperates with two fixed contacts (20, 21), which are arranged on opposite sides of the movable contact (10), **characterized in that** the movable contact (10) is adapted, in the closed position of the electric switching device, to be pressed against the fixed contacts (20, 21) with the aid of a torsion spring (18) which extends substantially parallel to said rotational axis (A) and which on one side of the movable contact is in engagement with the movable contact and on the opposite side is in engagement with the stand (28) of the electric switching device.

2. An arrangement according to claim 1, **characterized in that** the torsion spring (18) is eccentrically placed in relation to the rotational axis of the movable contact (10).

3. An arrangement according to claim 1 or 2, **characterized in that** the movable contact (10) comprises an elongated, straight contact arm (11) which, at its ends and on opposite sides of the longitudinal axis of the contact arm (11), supports contact elements (12) which cooperate with corresponding contact elements (23) on the fixed contacts (20, 21).

4. An arrangement according to claim 3, **characterized in that** the movable contact arm (11) is provided with a contact carrier (13) fixed on the central part of the contact arm.

5. An arrangement according to claim 4, **characterized in that** the bearing shaft (14) of the movable contact (10) constitutes an integral part of the contact carrier (13).

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6. An arrangement according to claim 3 or 4, **characterized in that** the contact carrier (13) is formed with an attachment (16) for the torsion spring (18), permitting the spring to be fixed to the movable contact carrier (13) before this is fitted into the electric switching device.

7. An arrangement according to any of the preceding claims, **characterized in that** the movable contact arm (11) is arranged between two shielding walls (28) with U-shaped guide slots (29), directed transversally of the longitudinal direction of the contact arm, for the bearing shaft (14) of the contact arm.

8. An arrangement according to claim 7, **characterized in that** one end portion of the torsion spring (18) is positioned in one of the U-shaped slots (29) and is thereby positioned closer to the bottom of the slot than the bearing shaft (14).

9. An arrangement according to claim 6, 7 or 8, **characterized in that** one end portion of the torsion spring (18) is shaped such that the engagement of the spring is automatically transferred to the adjacent shielding wall (28) when the movable contact (10) with the spring (18) is inserted into the breaker stand.

10. An arrangement according to any of claims 3-9, **characterized in that** the movable contact arm has circular cross section.

FIG. 1

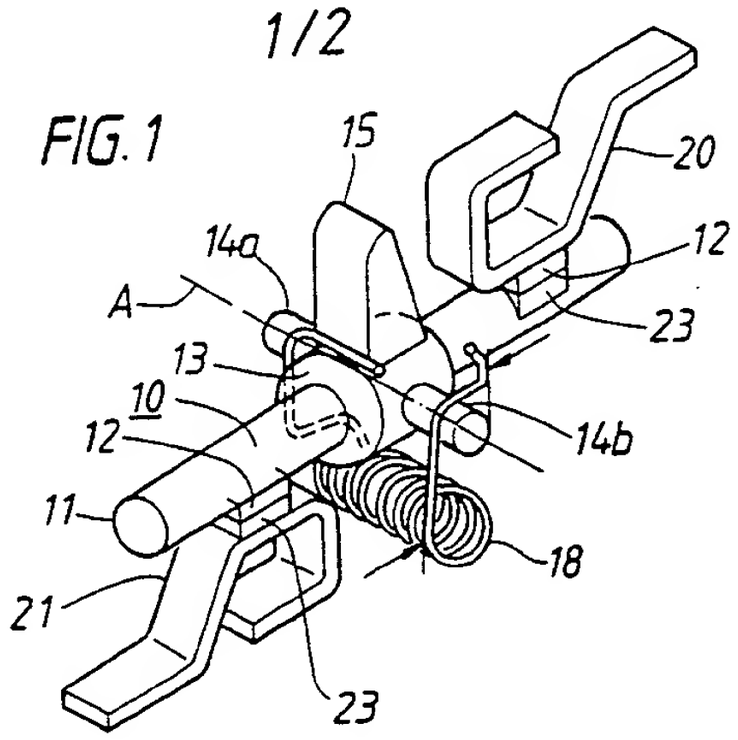

FIG. 2

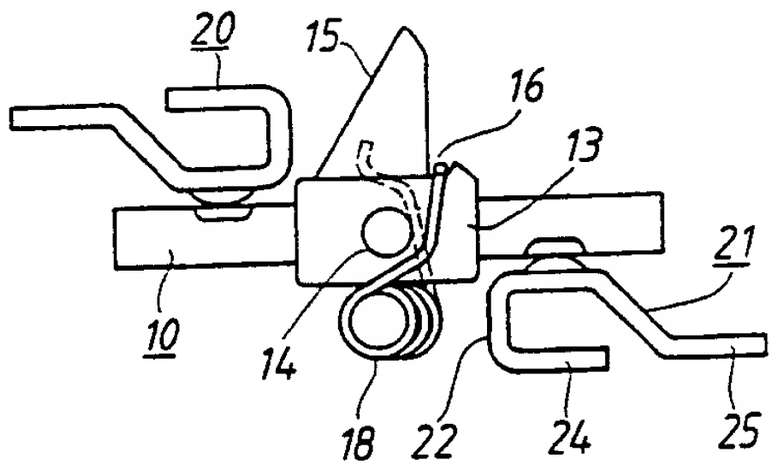

FIG. 3

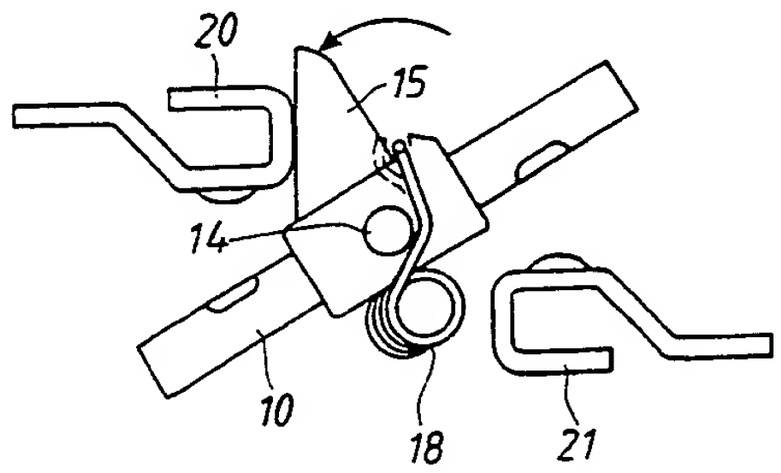

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FIG. 4

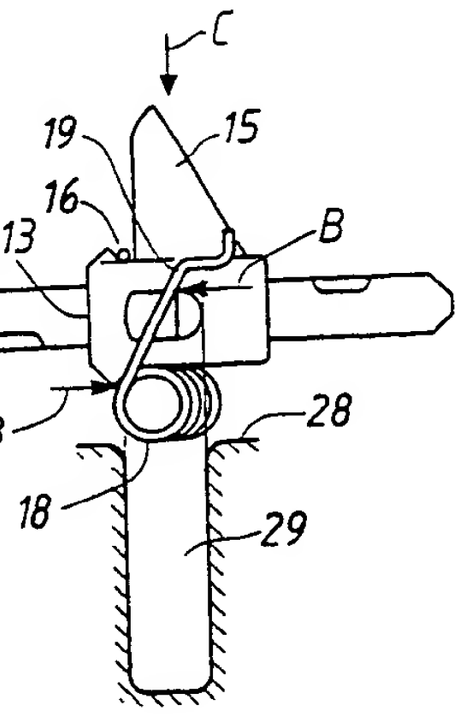


FIG. 5

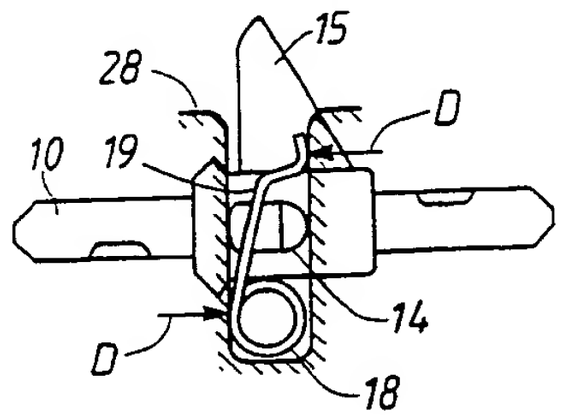
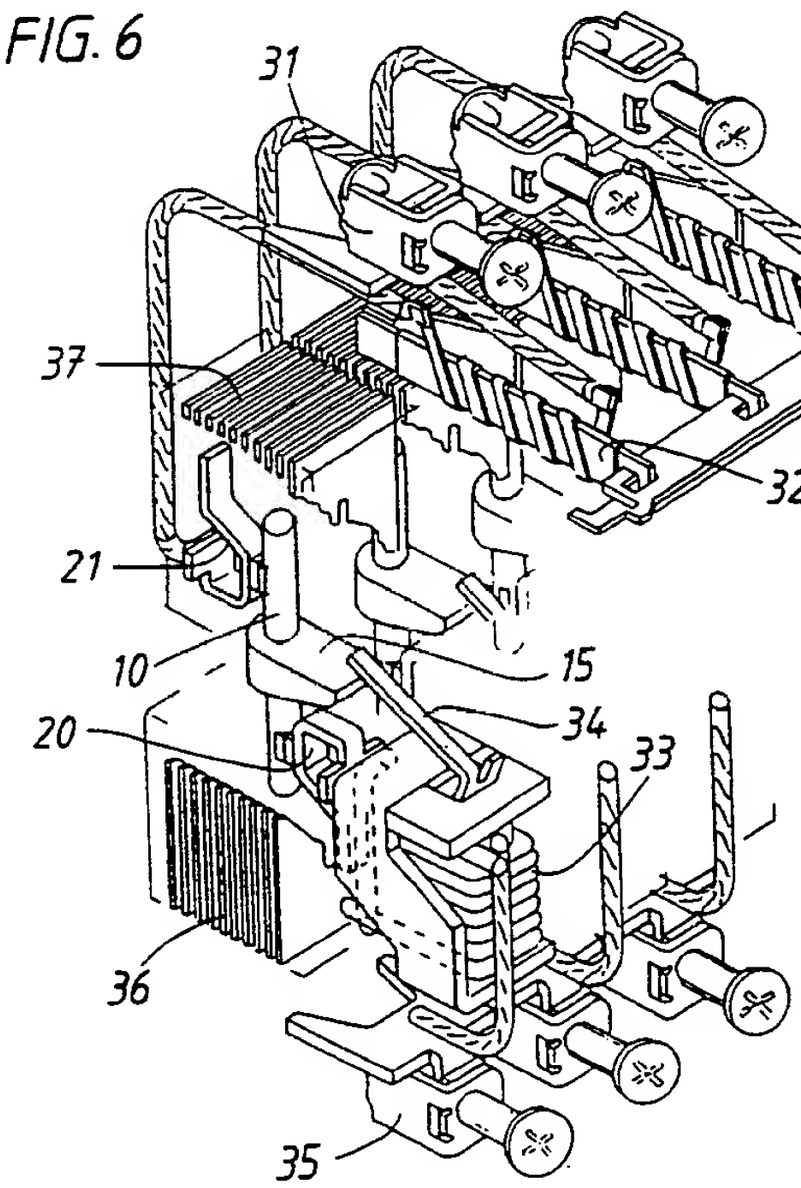


FIG. 6



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INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 91/00449

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: H 01 H 1/50

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	H 01 H

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	SE, B, 461557 (ASEA BROWN BOVERI AB) 26 February 1990, see abstract --	1,3-6, 10
X	EP, A1, 0174904 (SIEMENS AKTIENGESELLSCHAFT) 19 March 1986, see page 7, line 23 - page 8, line 20; figure 2 --	1,3
A	DE, A1, 2845950 (HOMA GESELLSCHAFT FÜR HOCHSTROM-MAGNETSCHALTER) 24 April 1980, see page 6, line 17 - page 7, line 16; figures 1-5 --	1-6, 10
A	EP, A2, 0309923 (CGE-COMPAGNIA GENERALE ELETTROMECCANICA S.P.A.) 5 April 1989, see abstract --	1,2

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
24th September 1991	1991 -09- 30
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	BERTIL NORDENBERG

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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	US, A, 3453566 (YASUO KASAHARA) 1 July 1969, see column 3, line 40 - line 42; figure 4 -- --------	1,2

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 91/00449

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 91-08-30
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
SE-B- 461557	90-02-26	EP-A-	0394922	90-10-31
		JP-A-	2304819	90-12-18
		US-A-	5030804	91-07-09
EP-A1- 0174904	86-03-19	CA-A-	1258283	89-08-08
		DE-A-	3431288	86-03-06
		DE-A-	3562537	88-06-09
		JP-A-	61061319	86-03-29
		US-A-	4649247	87-03-10
DE-A1- 2845950	80-04-24	NONE		
EP-A2- 0309923	89-04-05	JP-A-	1117228	89-05-10
US-A- 3453566	69-07-01	CH-A-	455918	00-00-00
		DE-A-	1588676	70-08-13
		FR-A-	1510415	00-00-00
		GB-A-	1182351	70-02-25
		NL-A-	6701676	67-08-07